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May 12, 2010

FILED/ACCEPTED

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Federal Communications Commission
Office of the Secretary

VIA HAND DELIVERY
Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: *Request for Waiver to Permit Channel Aggregation by Non-MVPD Users of the 18 GHz Band*

Dear Ms. Dortch:

BridgeWave Communications, Inc. ("BridgeWave"), a vendor of fixed microwave equipment used for high-capacity backhaul services, by its undersigned counsel, respectfully requests that the Commission issue a limited waiver of Section 101.147(r) of its rules to authorize fixed users of BridgeWave's radios to aggregate contiguous channels for operation over a single carrier in the 17.7-19.7 (18 GHz) band, subject to the requirement that such operation otherwise comply with all relevant Part 101 technical rules (power, out of band emissions, etc.). In essence, BridgeWave is merely asking that users of its 18 GHz radios be afforded channel aggregation rights comparable to those the Commission already affords to backhaul providers who operate in the 24 and 39 GHz bands.[1]

As discussed below, expedited treatment of BridgeWave's waiver request would serve the public interest. Due to the timing of the company's product development cycle and the rapidly accelerating demand by BridgeWave's customers for high-capacity backhaul solutions for 4G wireless networks, it is imperative that BridgeWave be in a position to commercially launch its new 18 GHz radios before the end of this year. This, in turn, will help the Commission achieve its larger objective of facilitating near-term deployment of 4G networks and other new broadband alternatives without creating any new interference risks to other users of

[1] *See* 47 C.F.R. § 101.109(c), note 7 (channel aggregation rights in the 24 GHz and 39 GHz bands). The Commission also permits channel aggregation by multichannel video programming distributors ("MVPDs") in the 18 GHz band. *Id.* § 101.147(r)(6); Rechannelization of the 17.7-19.7 GHz Frequency Band for Fixed Microwave Services under Part 101 of the Commission's Rules, *Report and Order*, 21 FCC Rcd 10900, 10907 (2006).

the spectrum.[2] Moreover, the instant waiver request incorporates certain conditions that the Commission has required in prior waiver cases, including, *inter alia*, a mandate that usage of BridgeWave's 18 GHz radios under the requested waiver shall be subject to permanent rules that the Commission may adopt in any future rulemaking proceedings affecting channel aggregation in the 18 GHz band.[3]

Background

BridgeWave, based in Santa Clara, CA, develops and supplies multi-gigabit wireless backhaul solutions for broadband networks serving the residential, commercial, educational, public safety and health care sectors. The company has been an industry leader in developing "wireless fiber" backhaul products that operate in the millimeter wave spectrum, particularly the 60 GHz and 80 GHz bands. Most recently, for example, BridgeWave introduced the newest version of its FlexPort family of high-capacity 80 GHz radios for mobile backhaul.[4] These radios provide up to 1.2 gigabits (Gbps) of backhaul capacity, with planned product rollouts for rates up to 2.5 Gbps – five to ten times the capacity of single-channel, lower frequency radios at significantly lower per megabit cost.[5]

At the same time, because millimeter wave signals travel shorter distances and may be more vulnerable to rain fade than lower frequency signals, there will be situations in which broadband providers will prefer a wireless backhaul solution that operates at lower frequencies. Accordingly, BridgeWave is developing backhaul radios that operate below 40 GHz, combining the longer link distances in the lower frequencies with the multi-gigabit capacity BridgeWave already provides with its millimeter wave radios. One of those sub-40 GHz radios, the FlexPort 18-1000, will operate in the 18 GHz band, and will be capable of transmitting multi-gigabit

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[2] *See, e.g., Alvarion Ltd*, FCC File No. LKT-BMAX-SI36, *Order*, DA 10-676 ¶ 11 (WTB and OET, rel. Apr. 22, 2010) (Commission waives certain power and power density limits for mobile devices in 3.65 GHz band, asserting that "strict application of Section 90.1321(c) would not further the underlying purposes of the rules and ... granting a waiver, subject to conditions, better serves the public interest by furthering the Commission's underlying purpose of fostering the deployment of new broadband technologies without undermining the protections that the Commission adopted for grandfathered operations") ["*Alvarion*"].

[3] *See Fibertower, Inc.*, 21 FCC Rcd 6386, 6387 (WTB 2006) ["*Fibertower*"]; Amendment of Part 15 of the Commission's Rules to Establish Regulations for Tank Level Probing Radars in the Frequency Band 77-81 GHz, *Notice of Proposed Rulemaking and Order*, 25 FCC Rcd 601, 620-21 (2010) (Commission waives Section 15.205(a) of its rules pending completion of associated rulemaking, to permit marketing of devices incorporating new tank level probing radar (TPLR) technology).

[4] *See* BridgeWave Press Release, *BridgeWave Brings Quality of Service Functionality to High-Capacity Multi-Gigabit 4G WiMAX and LTE Networks* (Mar. 18, 2010), *available at* http://www.bridgewave.com/company/pressreleases_20100318-2.cfm.

[5] *Id.*

backhaul links as long as 3.355 miles, nearly three times as long as those achievable in the 80 GHz band and five times as long as those achievable in the 60 GHz band.

As noted above, users of BridgeWave's radios are already permitted to aggregate channels (and thus would not require a waiver) in the 24 GHz and 39 GHz bands. However, similar channel aggregation rights are not available to fixed users in the 18 GHz band, even where an 18 GHz user is providing backhaul services identical to those provided at 24 GHz and 39 GHz. Moreover, the need for channel aggregation at 18 GHz is just as compelling (if not more so) as that at 24 GHz and 39 GHz, due to the bandwidth limitations on individual channels in Part 101. Section 101.147(r)'s frequency plan for the 18 GHz band assigns a maximum channel bandwidth of up to 80 MHz per channel, far less than what is required to sustain a reliable multi-gigabit capacity backhaul solution.[6] BridgeWave estimates that an 80 MHz channel at 18 GHz would provide a raw bit rate of 640 Mbps; a true "GigE" link, on the other hand, requires a raw bit rate of 1.2 Gbps raw bit rate and, therefore, a channel bandwidth of 150 MHz.

This problem can be avoided by aggregating contiguous 18 GHz channels and operating them over a single RF carrier. For example, an 18 GHz user could aggregate three contiguous 50 MHz channels to create a single 150 MHz channel that can be transmitted with a single radio. As shown in Exhibit A hereto, such single carrier operation achieves a longer link distance than what is achievable with three carrier operation, with the additional advantage of lower cost. This would also enable BridgeWave to achieve economies of scale in the manufacturing and sale of its 18 GHz, 24 GHz and 39 GHz radios, since aggregation of 50 MHz channels is already permitted in the latter two bands. And, as discussed in Exhibit B hereto, BridgeWave's proposed operation over three aggregated 50 MHz channels via a single carrier creates no new interference implications for other users of the 18 GHz band, assuming compliance with the other relevant Part 101 rules.

The Requested Waiver Satisfies the Relevant Legal Standard

Under Section 1.925, the Commission may grant a waiver of its rules if it is shown that either (1) the underlying purpose of the rule(s) would not be served or would be frustrated by application to the instant case, and that a grant of the requested waiver would be in the public interest; or (2) in view of the unique or unusual circumstances of the instant case, application of the rule(s) would be inequitable, unduly burdensome or contrary to the public interest, or the applicant has no reasonable alternative.[7] The waiver requested herein satisfies both prongs of this test and related Commission precedent.

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[6] *See* 47 C.F.R. § 101.147(r)(12).

[7] *Id.*. § 1.925(b)(3). *See also FiberTower*, 21 FCC Rcd at 6391.

Accelerated nationwide deployment of 4G wireless networks, and the new services and spectral efficiencies arising therefrom, depend in no small part on the availability of sufficient backhaul capacity. The National Broadband Plan leaves no doubt about this:

> Mobile broadband network availability will change rapidly because of these deployments. Improved spectral efficiencies and significantly lower network latencies are some of the features of 4G networks that could lead to a better mobile broadband experience. . . The extent to which the effect of these advances are reflected in users' experiences will depend on a variety of factors, including the amount of spectrum dedicated to mobile broadband and the availability of high-speed backhaul connections from cellular sites.[8]

It is equally clear that the anticipated consumer demand for 4G wireless services will only intensify the need for additional backhaul capacity.[9] Clearwire, for example, recently stated that it expects to increase its total backhaul capacity by 250 percent or more, with long-term capability to support gigabit per second speeds in high-density, high-traffic areas.[10] Verizon Wireless aims to supply 100 megabit links to its cell sites as it moves to Long-Term Evolution ("LTE").[11] Yet, for the broadband industry generally, only a relatively small number of backhaul links have been upgraded to fiber. In fact, some estimate that "less than 10% of the backhaul connections which connect mobile data towers to the carrier's core network are fiber. The rest are in many cases old copper lines that have connection speeds as small as 1.54 Mbps (T-1 lines)."[12]

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[8] FCC, *Connecting America: The National Broadband Plan*, at 22 (Mar. 16, 2010) (citation omitted) ["NBP"]; *see also id.* at 78 ("[Unlocking the full potential of 4G] cannot focus solely on 'last mile' mobile connectivity, but also needs to address other potential network bottlenecks that inhibit speed, including backhaul and other point-to-point applications.").

[9] *See, e.g., id.* at 77 ("An increase in mobile broadband use raises demand for other wireless services, such as point-to-point microwave backhaul and unlicensed networks, to enhance the overall delivery of broadband.").

[10] *See* Clearwire Corp. Press Release, *Clearwire Extends 4G Leadership in the United States*, (Mar. 23, 2010), *available at* http://tinyurl.com/y8zka7r. Clearwire also estimates that its 4G networks will reach 120 million consumers by the end of 2010, and that its existing 4G customers on average are already consuming over 7 GB of data per month. *Id.*

[11] *See* Dan Jones, *Verizon's Backhaul Speed Race*, Light Reading Mobile (Apr. 6, 2010), *available at* http://tinyurl.com/y2wgo7d. Verizon Wireless has indicated that its LTE services will reach 25-30 cities covering a population of 100 million people by the end of 2010. *See Verizon's Lynch: LTE Going Live in Q4*, Sidecut Reports, Apr. 15, 2010, 9:45 EDT, *available at* http://tinyurl.com/y7s2m2h (last viewed Apr. 19, 2010).

[12] *See* R. Scott Raynovich, *CTIA: Mobile Backhaul Buzz*, The Rayno Report available at http://raynoreport.com/2010/03/ctia-backhaul-buzz (last visited Apr. 19, 2010).

Recognizing the problem, the Commission made a series of recommendations in the NBP to increase the flexibility, capacity and cost-effectiveness of spectrum for point-to-point wireless backhaul services. In particular, the Commission recommended the commencement of a rulemaking proceeding specifically targeted at maximizing use of Part 101 spectrum for backhaul services.[13] According to the Commission's current schedule of post-NBP proceedings, that rulemaking will begin during the third quarter of this year.[14] BridgeWave applauds the Commission's initiative on Part 101 reform, and looks forward to working with the agency and other interested parties in developing permanent channel aggregation rules that will optimize the 18 GHz band and other Part 101 spectrum for high-capacity backhaul services (*e.g.*, the 10 MHz, 11 GHz, and 23 GHz bands).

In the interim, however, there remains the question of how the Part 101 spectrum can be optimized to meet the *immediate* demand for high-capacity backhaul solutions that can be deployed quickly and at reasonable cost. 4G providers are already in the process of launching networks that will reach millions of consumers; while some will utilize fiber backhaul, others will prefer the cost efficiencies and time to deployment advantages of wireless backhaul solutions that can operate in multiple, licensed Part 101 frequency bands.[15] While the Commission is already making important progress on this front, the demands of the National Broadband Plan suggest that even more can and should be done pending completion of the Commission's post-NPB rulemaking on Part 101 reform.[16]

The Commission has granted similar waiver requests where, as in the instant case, the requested waiver facilitates innovation and near-term deployment of new broadband service without creating any additional interference risks or effectively nullifying the relevant Commission rules before completion of any related rulemaking proceedings. The public interest considerations that informed those Commission decisions apply with equal force to this case.[17] Furthermore, BridgeWave voluntarily agrees to the following conditions in advance:

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[13] *See* NBP at 93-94.

[14] *See* FCC, *Proposed 2010 Key Broadband Action Agenda Items*, *available at* http://www.broadband.gov/plan/broadband-action-agenda-items.html (last visited May 11, 2011).

[15] *See* Amendment of Part 101 of the Commission's Rules to Accommodate 30 Megahertz Channels in the 6525-6875 MHz Band, *Notice of Proposed Rulemaking and Order*, 24 FCC Rcd 9620, 9627 (2009) (noting demand for wider channel bandwidths in the 6525-6875 band).

[16] *Id.*

[17] *See, e.g., Alvarion* ¶ 13 ("The use of the BMAX-Si in accordance with the conditions set forth in this *Order* will provide terrestrial licensees in this band with more equipment options to encourage the rapid expansion of broadband services without compromising the interference protection afforded to grandfathered facilities."); *Fibertower*, 21 FCC Rcd at 6393 ("[W]e expect that FiberTower's deployment of 0.61 antennas in the 11 GHz band

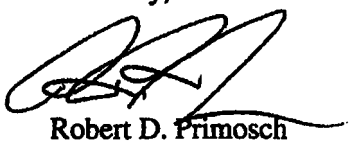
(a) BridgeWave shall advise its customers that all operations pursuant to the requested waiver must otherwise comply with the relevant Part 101 technical rules.

(b) For any BridgeWave 18 GHz radio that is designed and equipped to operate under the requested waiver, BridgeWave shall include sufficiently detailed installation instructions and guidelines to ensure that users of those radios are informed of the terms and conditions of the waiver and their obligations thereunder.

(c) BridgeWave's customers will be advised that any operations under the requested waiver will be subject to any action the Commission may take in its post-NBP Part 101 rulemaking (or any other similar proceeding) that affects channel aggregation in the 18 GHz band.

BridgeWave would be happy to answer any questions the Commission may have about any of the information supplied above. Any inquiries on this matter should be directed to the undersigned.

Sincerely,



Robert D. Primosch
Counsel for BridgeWave Communications Inc.

cc: Stephen Bueznow (via e-mail)
Jamison Prime (via e-mail)

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pursuant to the instant waiver will facilitate . . . the roll-out of 3G services in the near term while appropriately protecting other users in the band from interference.").

EXHIBIT A

18 GHz Link Performance Estimate

BridgeWave compared two 18 GHz links having identical system parameters, except that one link used single carrier 150 MHz channel with transmit power of +19 dBm, while the other link used three separate 50 MHz channels/carriers, which can be adjacent or separated in the 18 GHz band.

Reference system parameters:

System Type	Single carrier, 150 MHz	Three 50 MHz carriers
TX Frequency	18.000 GHz	18.000 GHz
TX power (RMS)	19 dBm	14 dBm*
Antenna Gain (2 ft)	38.5 dB	38.5 dB
Modulation	256 QAM	256 QAM
User bit rate	1000 Mbps	1000 Mbps
Receive Sensitivity	-55 dBm	-55 dBm
Rain availability model	ITU	ITU
Location for rain model	New York	New York
Availability target	99.995%	99.995%
Distance	3.355 mile	2.684 mile

* Three-carrier operation requires lower power (thus resulting in shorter link distance) because the peak-to-RMS ratio of the signal is 5 dB higher, requiring the amplifier to "back off" 5 dB and use lower transmit power as compared to the same amplifier in a single carrier configuration.

EXHIBIT B

Transmission of a Single-carrier Signal in a Block of Three Adjacent 50 MHz channels

Background

The recent increase in the data rate requirements of fixed point to point links has made the existing channel bandwidths of sub-40 GHz Part 101 frequencies incapable of supporting full speed gigabit Ethernet ("GigE"). While channels in the 71-76 GHz and 81-86 GHz bands are adequate for this purpose, rain-affected signal propagation restricts the useful link distance in that spectrum. Spectrum from 18 GHz to 40 GHz is a viable alternative – however, the widest bandwidth permitted in that spectrum range is only 50 MHz. The desired bit rate can be obtained by splitting the data stream three ways and using an aggregate three adjacent radio channels. Such channel aggregation is allowed in some Part 101 bands, as evident from 101.109 Footnote 7 which is quoted below:

> [7]For channel block assignments in the 24,250–25,250 MHz and 38,600–40,000 MHz bands, the authorized bandwidth is equivalent to an unpaired channel block assignment or to either half of a symmetrical paired channel block assignment. When adjacent channels are aggregated, equipment is permitted to operate over the full channel block aggregation without restriction.
>
> Note to Footnote 7: Unwanted emissions shall be suppressed at the aggregate channel block edges based on the same roll-off rate as is specified for a single channel block in §101.111(a)(1) or in §101.111(a)(2)(ii) and (iii) as appropriate.

This document describes a single-carrier operating mode over three aggregate channels. The objective is to validate that this mode interprets correctly the FCC's intention in the above-quoted Footnote 7, and could be utilized at 18 GHz with no adverse interference consequences.

Single-Carrier Aggregation

Figure 1 (a) depicts a conventional aggregation of three radio modems, 50 MHz each, onto a single radio utilizing a block of three channels in what is essentially frequency division multiplex mode (FDM). Figure 1(b) depicts the desired single carrier mode, i.e., a single modem running at a triple of the symbol rate of each of the above modems.

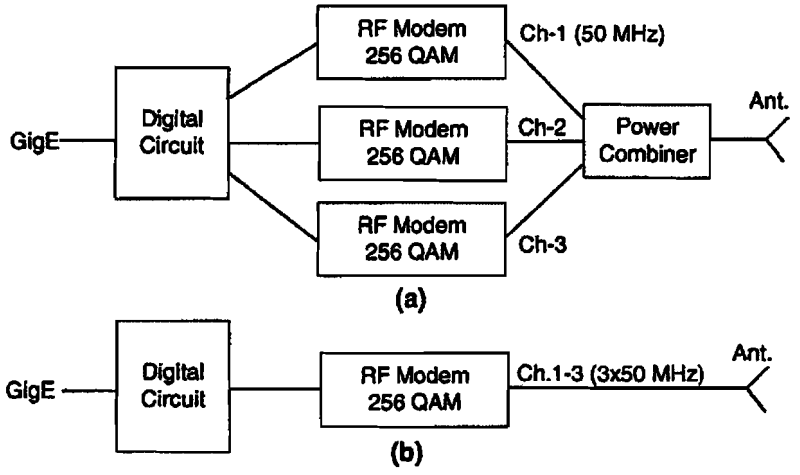

Figure 1: FDM and Single Carrier aggregation options

The emission masks of three separate channels (FDM) and a single channel are illustrated in Figure 2.

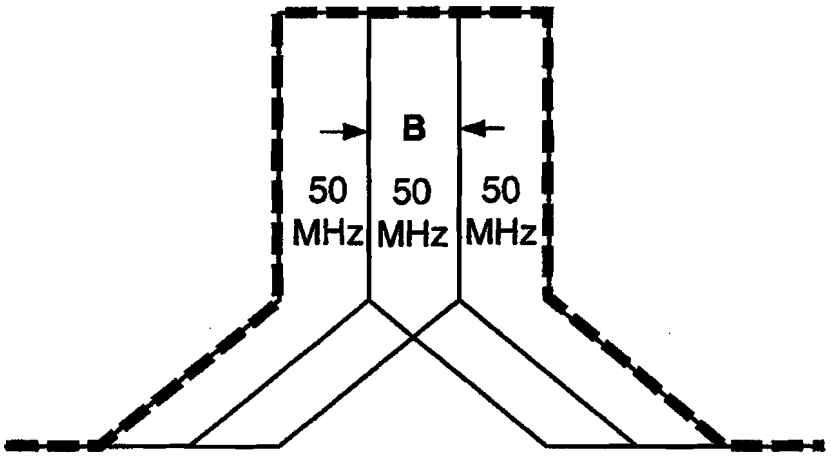

Figure 2: Emission Masks (not to scale)

Clearly, the single carrier mask (dashed line) conforms to the above Footnote 7.

Single-Carrier Advantages

The simplification of circuitry is obvious from Figure 1. In addition, a single carrier peak-to-average power ratio is lower by approximately 5 dB from the equivalent FDM implementation, allowing the use of a more power efficient RF amplifier. Recent technological advances have made single carrier modems at 150 MHz bandwidth economically advantageous over the aggregation of three modems.

The two options are virtually identical in their co-channel interference tolerance. The interference from single 150 MHz carrier to any same-band single 50 MHz channel receiver is essentially the same as that from a FDM transmitter. For frequency planning purpose, the two options can be considered identical.

DECLARATION OF IDAN BAR-SADE

I, Idan Bar-Sade, hereby declare under penalty of perjury as follows:

1. I am Senior Vice President for Engineering and Product Management at BridgeWave Communications, Inc.

I have reviewed BridgeWave's foregoing submission to the FCC. The facts set forth therein are true to the best of my knowledge, information and belief.

/s/ Idan Bar-Sade
Idan Bar-Sade

Executed on May 12, 2010